High-Performance BaraECD® Fluid System Enables Operator to Drill Successfully on Slim-Hole HPHT Well in Bolivia

SAN ISIDRO, BOLIVIA

OVERVIEW

An operator in San Isidro, Bolivia, needed to perform a reentry of an existing well. This well was abandoned previously due to high pump pressure values when drilling with a standard non-aqueous fluid (NAF) system; also, due to casing integrity issues in the original wellbore, a 7-inch casing was set back to surface, making it far more difficult to minimize the equivalent circulating density (ECD) value due to the tight annular clearance over the entire well.

The operator challenged Baroid to provide a fluid solution that would allow for drilling a 6-inch hole from a casing depth of 4,861 meters (15,948 feet) to 6,100 meters (20,013 feet) without surpassing an ECD value of 17.5 lb/gal; which would risk fracturing the casing shoe.

Projected mud weights were as high as 16.7 lb/gal to control the formation pore pressures.

BAROID SOLUTION PROVES TO BE ESPECIALLY SUITED FOR NARROW MARGIN DRILLING APPLICATIONS

The technical limitations for standard NAF systems had held back the drilling operation to the existing shoe depth; swapping to a lower rheology fluid in order to reduce ECD and standpipe pressures (SPPs) might risk barite sag and/or settling issues, as evidenced in the past. Potential low-ECD solutions included the use of micronized weighting agents and/or high-density brines as the aqueous phase. These were discounted due to the cost impacts of purchasing, importation, and shipping. As part of the fluid parameter requirements, the fluid had to maintain a low rheology profile to allow high pump rates for adequate hole cleaning, and it had to be able to remain stable under downhole high-pressure/high-temperature (HPHT) conditions, such as a bottomhole static temperature (BHST) of 315°F (157°C) with over 17,500 psi of pressure. Baroid implemented its Technical Process, with extensive testing to customize a fluid solution that matched or exceeded the

SOLUTION

Baroid proposed the BaraECD® NAF system, delivering several benefits:

» Specialized rheology profile with a healthy Tau zero value and minimum PV/YP
» Rheology allowed for optimal pump rates for drilling without exceeding standpipe pressure (SPP) limits
» Very stable fluid properties with no degradation due to temperature

RESULTS

» BaraECD® fluid maintained a low rheology profile, which mitigated the risk of fractures due to ECD
» Minimum seepage losses to micro-fractures
» Fragile gel strength allowed for trips and logging (five days) with no issues
» Drilling time was reduced by 40 days from the planned authority for expenditure (AFE)

Figure 1. Operational parameters with the high-performance BaraECD® NAF system.

DRILLING TIME SAVED

40 days/approximately $6M

Reduced Rig Time and Weighting Materials, Lower System Maintenance Costs

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customer’s specified design targets. Baroid proposed the high-performance BaraECD® NAF system as an economical system that could be built on site by using available standard weighting materials and base fluids. The BaraECD fluid is an organophilic clay-free NAF that has both a fragile gel structure and a flat rheology profile. It is especially suited for narrow margin drilling applications such as the challenge presented here.

During the operation, the high-performance BaraECD fluid maintained low rheology values throughout, making it possible to achieve ideal pump rates with controllable SPPs (< 3,900 psi) at 150–165 gpm while controlling the ECD below 16.8 lb/gal, thus eliminating the risk of fracturing the formation while circulating and drilling (Figure 1).

The low ECD also helped to minimize seepage losses in the micro-fractured formations at the top of the section. The fragile gel structure of the BaraECD NAF system allowed for tripping operations (in and out of the hole), and for a successful series of four wireline logs at target depth without any operation-induced sag incidents.

**ECONOMIC VALUE CREATED**

The wellbore was finished ahead of schedule and far below the planned budget. Since the high-performance BaraECD NAF system can utilize a wide range of base fluids and weighting materials while still providing a low ECD profile (Figure 2), there was no need to import alternate specialized weighting materials and/or fluids; these would have meant an incremental cost of at least USD 1.8 million for the fluid system, and potentially more.

On previous offset wells, the rate of penetration (ROP) was seriously impaired by the pump rate, hole cleaning issues, and high rheology values. With Baroid’s solution, the operator was able to reach optimal pump rates, resulting in improved hole cleaning at high ROP, thereby chopping 40 days off the planned drilling timeline. This translated to USD 4 million saved in rig costs.

The optimized chemistry of the high-performance BaraECD fragile-gel NAF system allowed for reduced maintenance costs compared to standard NAF systems. Fluid maintenance for the BaraECD system was only 3 percent of the total of total fluid expenses, compared with 10 percent in the past using a standard NAF. All this together brought the total savings for the customer to approximately USD 6 million. With this level of savings, the customer proposed to drilling additional wells by using the same high-performance BaraECD NAF system.

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**CASE STUDY**

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